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TITLE: ELECTRIC DOUBLE LAYERED CAPACITOR  
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ABSTRACT:

PROBLEM TO BE SOLVED: To provide an electric double layered capacitor which can suppress the capacitance deterioration caused by the decomposition of the electrolyte over a wide range and can be used for a long period.

SOLUTION: An electrode/separator laminated body 12 impregnated with an electrolyte is housed in a container 10. The container 10 is closed with a lid 18 welded to the container 10 and the pressure in the container 10 is reduced to a negative pressure through an opening 24 by opening a valve 26 and the inside of the container 10 is maintained at the negative pressure. Therefore, even when the electrolyte is decomposed on the surface of the activated carbon constituting the electrode of the laminated body 12 and a gas is produced, the capacitance deterioration caused by an impediment to the ion adsorption to the surface of the activated carbon can be prevented.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] however, CO<sub>2</sub> which the electrolytic solution decomposes within a container and is generated by it in the above-mentioned conventional technology although the burst of the container of an electric double layer capacitor can be prevented etc. -- gas was wearing a part of activated carbon front face, and before the explosion-proof valve operated, there was a problem that the electrostatic capacity of an electric double layer capacitor fell

[0005] That is, since the decomposition reaction of the electrolytic solution is produced on the activated carbon front face of the electrode section, and the current collection foil front face on which activated carbon is applied, the gas which occurred by this decomposition will adhere to an activated carbon front face, and will cover the part. For this reason, in the portion covered by gas, it becomes impossible to perform accumulation of electricity by adsorption of ion, and the part electrostatic capacity will fall.

[0006] Moreover, if the pressure in a container rises and an explosion-proof valve operates, thereby, in a container, the open air will enter and moisture will mix. When moisture invaded and use is generally resumed after that with an electric double layer capacitor, this moisture is electrolyzed, and it is H<sub>2</sub> and O<sub>2</sub>. It is thought that gas occurs or degradation of the electrolytic solution resulting from moisture mixing arises, and the fall of the capacity of an electric double layer capacitor becomes remarkable according to these causes. Therefore, if possible, time until the pressure in a container rises and an explosion-proof valve operates needed to be lengthened.

[0007] this invention is made in view of the above-mentioned conventional technical problem, and the purpose can suppress sharply the fall of the electrostatic capacity by decomposition of the electrolytic solution, and is to offer the electric double layer capacitor which can be used for a long period of time.

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[Translation done.]

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to fall prevention of the electrostatic capacity of an electric double layer capacitor especially about the electric double layer capacitor used for an energy storage.

[0002]

[Description of the Prior Art] The electric double layer capacitor is conventionally used for storage of electrical energy. although dry air etc. is sealed in the container at the beginning and it is maintained by the atmospheric pressure state in such an electric double layer capacitor, if charge and discharge are repeated for a long period of time -- gradually -- the electrolytic solution -- decomposing -- CO and CO<sub>2</sub> etc. -- gas occurs and the pressure in a container rises Since there is a possibility that a container may explode by elevation of this container internal pressure, the explosion-proof valve is usually attached in the container so that the internal pressure can be extracted outside at the time of internal pressure elevation. The example of such an electric double layer capacitor is indicated by JP, 1-73921, U.

[0003] In the above-mentioned official report, many things are devised, and when the internal pressure of an electric double layer capacitor rises more than a tolerance limit and an explosion-proof valve operates, the technology which decompresses the internal pressure of a container quickly is proposed.

[0004]

[Problem(s) to be Solved by the Invention] however, CO<sub>2</sub> which the electrolytic solution decomposes within a container and is generated by it in the above-mentioned conventional technology although rupture of the container of an electric double layer capacitor can be prevented etc. -- gas was wearing a part of activated carbon front face, and before the explosion-proof valve operated, there was a problem that the electrostatic capacity of an electric double layer capacitor fell

[0005] That is, since the decomposition reaction of the electrolytic solution is produced on the activated carbon front face of the polar zone, and the current collection foil front face on which activated carbon is applied, the gas which occurred by this decomposition will adhere to an activated carbon front face, and will cover the part. For this reason, in the portion covered by gas, it becomes impossible to perform accumulation of electricity by adsorption of ion, and the part electrostatic capacity will fall.

[0006] Moreover, if the pressure in a container rises and an explosion-proof valve operates, thereby, in a container, the open air will enter and moisture will mix. When moisture invaded and use is generally resumed after that with an electric double layer capacitor, this moisture is electrolyzed, and it is H<sub>2</sub> and O<sub>2</sub>. It is thought that gas occurs or degradation of the electrolytic solution resulting from moisture mixing arises, and the fall of the capacity of an electric double layer capacitor becomes remarkable according to these causes. Therefore, if possible, time until the pressure in a container rises and an explosion-proof valve operates needed to be lengthened.

[0007] this invention is made in view of the above-mentioned conventional technical problem, and the purpose can suppress sharply the fall of the electrostatic capacity by decomposition of the electrolytic solution, and is to offer the electric double layer capacitor which can be used for a long period of time.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention is the electric double layer capacitor which contained that into which the laminating of the polarizable electrode of positive/negative was carried out through separator, and the electrolytic solution was infiltrated in the predetermined container, and it is characterized by making the inside of a container into a negative pressure state in the first half.

[0009]

[Embodiments of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained based on a drawing.

[0010] The cross section of the composition of the electric double layer capacitor concerning this invention is shown in drawing 1, the cross section from the side is shown in drawing 1 (a), and the cross section from a transverse plane is shown in drawing 1 (b), respectively.

[0011] In drawing 1, the electrode / separator layered product 12 which carried out the laminating of the polarizable electrode of positive/negative through separator are held in the container 10. Both the positive electrodes and negative electrodes of this polarizable electrode apply to both sides of an aluminum current collection foil the paste which consisted of activated carbon, carbon black, and PTFE as a binder, and dry and press it in them. The porosity film made from a

polyolefine is used as separator.

[0012] The positive-electrode terminal 14 and the negative-electrode terminal 16 of a polarizable electrode are connected to the positive-electrode terminal 20 and the negative-electrode terminal 22 which were prepared in the lid 18 of a container 10, respectively.

[0013] The opening 24 used for it when decompressing the inside of a container on a lid 18 is formed, and the bulb 26 for opening and closing opening 24 is formed in this opening 24.

[0014] Next, how to decompress the interior of a container 10 is explained. The container 10 and lid 18 which consist of stainless steel etc. are joined by welding etc., and the container 10 is sealed by this. Heating this container 10 at 100 degrees C, the inside of a container 10 is lengthened from opening 24 to a vacuum with a rotary pump by making a bulb 26 open, and a bulb 26 is closed after that. Next, the electrolytic solution of the specified quantity is poured in from opening 24, making a bulb 26 open, and let a bulb 26 be close after that. At this time, what dissolved mol [ of tetraethylammonium tetrafluoroborate / 1 / ], for example in propylene carbonatel. is used as the electrolytic solution.

[0015] Then, a rotary pump performs vacuum length from opening 24 by making a bulb 26 open further. The gas which remains inside an electrode / separator layered product 12 can fall out, and the electrolytic solution can be made to permeate and cross to the interior of an electrode / separator layered product 12 enough with this vacuum length. Then, a bulb 26 is shut and opening 24 is obturated.

[0016] In this invention, a characteristic point is having changed the interior of a container 18 into the negative pressure state. CO and CO<sub>2</sub> which this generated on the activated carbon front face which constitutes the electrode of an electrode / separator layered product 12 by decomposition of the electrolytic solution etc. etc. -- gas moves to the space portion 29 in a container 10 from an activated carbon front face, and can prevent adhesion of the gas on the front face of activated carbon. Therefore, adsorption of the ion in an activated carbon front face is not checked, but the fall of the capacity of an electric double layer capacitor can be prevented.

[0017] In addition, as shown in drawing 1 (b), when the explosion-proof valve 28 is formed in the lid 18, the internal pressure of a container 10 rises and a predetermined pressure is exceeded, it has prevented that this explosion-proof valve operates and a container 10 explodes.

[0018] The example of this explosion-proof valve is shown in drawing 2. A plug 32 is inserted in the hole 30 which was able to be opened in some lids 18, and the hole 34 for pressure relief is formed in this plug 32. The outside edge of this hole 34 is covered by the rupture disk 36 made of a resin.

[0019] When the internal pressure of a container 10 rises by the above composition, a rupture disk 36 will be torn and the pressure inside a container 10 will be emitted out of a container 10 from a hole 34.

[0020] In addition, when it is not restricted to the above structures, a valve serves as open as an explosion-proof valve at the time of an operation and the internal pressure of a container 10 falls, the thing of composition of that the valve closes may be used. In order to evaluate the performance of the electric double layer capacitor concerning this invention constituted as mentioned above, the repeat examination of charge and discharge was performed with the example of comparison.

[0021] It is N<sub>2</sub> which produced like the electric double layer capacitor concerning this invention as an example of comparison, and was finally dried in the container. It introduced and what made the pressure in a container 10 equal to atmospheric pressure was used.

[0022] The result which measured elevation of the internal pressure is shown in drawing 3, repeating the charge and discharge of an electric double layer capacitor. The result of the electric double layer capacitor concerning this invention is shown in A of drawing 3, and the result of the above-mentioned example of comparison is shown in B. As shown in drawing 3, in the example of comparison, that whose internal pressure was atmospheric pressure at the beginning went up to 760mmHg(s) by the repeat of 300,000 times of charges and discharges, and the explosion-proof valve operated here.

[0023] On the other hand, with the electric double layer capacitor concerning this invention, although internal pressure is made into negative pressure to -750mmHg at the beginning and the repeat of charge and discharge was started from this state, even if it performs the repeat of 350,000 times of charges and discharges, internal pressure rises only to about 200 mmHgs, but it turns out also at this time that it is still usable in respect of the internal pressure of a container 10.

[0024] The decreasing rate from the initial value of the capacity of the electric double layer capacitor to the repeat of charge and discharge is shown in drawing 4. A is an electric double layer capacitor concerning this invention like drawing 3, and B is the thing of the example of comparison.

[0025] When the decreasing rate from initial capacity exceeds 30% by the repeat of 300,000 times of charges and discharges in the example of comparison and 300,000 times or more of charges and discharges are repeated so that drawing 4 may show, a bird clapper turns out that use is difficult.

[0026] On the other hand, in the electric double layer capacitor concerning this invention, even if it repeats 350,000 times of charges and discharges, the decreasing rate of electrostatic capacity is about 20%, and compared with the example of comparison, it has checked that there were few decreasing rates of electrostatic capacity.

[0027]

[Effect of the Invention] CO and CO<sub>2</sub> which were produced by decomposition of the electrolytic solution since the inside of the container of an electric double layer capacitor was made into negative pressure according to this invention as explained above etc. -- gas moves to the space portion in a container, without remaining in an activated carbon front face. Consequently, it is lost that an activated carbon front face is being worn by gas, and the fall of electrostatic capacity can be suppressed.

sharply.

[0028] Moreover, since the inside of a container is made into the negative pressure state, time until an explosion-proof valve operates by the pressure buildup in the container by generating of the above-mentioned gas can be lengthened.

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